

## **CHAPTER 10**

### **INFORMATION FEEDBACK SYSTEMS**

**TED GEILEN**

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## CHAPTER 10

### INFORMATION FEEDBACK SYSTEMS

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#### I. INTRODUCTION AND SUMMARY

With Internet access to data collected by the AMI system, ratepayers will be able to make more-educated decisions about their use of energy for heating and cooling. Studies show that, when consumers can access timely information-feedback, they save money on their energy bills.

SDG&E's website presentation of personal energy use, collected through the Advanced Metering Initiative (AMI) system, will reduce SDG&E's 2007-2026 operating cost by a present value sum of \$29.6 million<sup>1</sup> (24% electricity, 76% gas). Most of these savings will come from reduced combustion of natural gas, which will have the added benefit of reducing peak energy use and greenhouse gas emissions.

Information-feedback has not been properly introduced and quantified in SDG&E's formal application. DRA recommends that the Commission direct SDG&E to recognize information-feedback as one of the primary residential consumer benefits of a well-designed AMI system and allocate management, design, and marketing efforts accordingly.

#### II. RATEPAYER SAVINGS AND PARTICIPATION

Individual residential ratepayers which avail themselves of the web display can, on average, reduce their annual electricity bill by \$7<sup>2</sup> and their natural gas bill

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<sup>1</sup> These calculations are further explained below and further detailed in DRA's workpapers. This cost estimate represents reduction in utility operating cost and is therefore far below the cumulative cost savings of individual ratepayers who utilize information feedback.

<sup>2</sup> See workpapers, using marginal price of electricity, 130%+ of baseline as of July 12, 2006.

1 by \$10<sup>3</sup>. Four Percent (4%)<sup>4</sup> of all SDG&E customers are expected to access their  
2 energy use data online in 2009, increasing to 28%<sup>5</sup> of customers by 2024.

3 SDG&E currently offers a website presentation of AMI energy use data, called  
4 “kWickview” but only to large commercial and industrial (C+I) consumers who  
5 already have interval meters. This data-heavy C+I presentation is good for plant  
6 managers and engineers, but the website presentation for residential ratepayers should  
7 be independently designed to serve the specific needs of, and be inviting to,  
8 residential ratepayers.

### 10 **III. FOLLOWING THE ENERGY ACTION PLAN (EAP)**

11 The website presentation of personal energy use would help ratepayers achieve  
12 the first goal in California's Energy Action Plan II, dated September 21, 2005:

13 *“As stated in the EAP I and reiterated here, cost effective energy*  
14 *efficiency is the resource of first choice for meeting California's energy*  
15 *needs. Energy efficiency is the least cost, most reliable, and most*  
16 *environmentally-sensitive resource, and minimizes our contribution to*  
17 *climate change. California's energy efficiency programs are the most*  
18 *successful in the nation and we want to continue to build upon those*  
19 *resources.”*

### 20 **IV. THE CONCEPT**

21 Residential ratepayers will be able to use SDG&E's website presentation of  
22 personal energy use to better understand the dollar-cost of heating and cooling their  
23 homes on a daily basis. Each ratepayer can choose the temperature and time  
24 controls on her thermostat, observe the cost of that heating and cooling the next day,  
25 and then make an educated and potentially revised decision going forward. This  
26 pedagogy is known as "information-feedback".

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<sup>3</sup> See workpapers, using marginal price of natural gas, baseline +, July 12, 2006.

<sup>4</sup> SDG&E Data Request # 33 response, July 21, 2006

<sup>5</sup> SDG&E Data Request # 33 response, July 21, 2006

1           Currently, the learning process of observation and action is severely limited,  
2   because information-feedback is only available in month-late format (monthly bills).  
3   Over the course of the month, heating and cooling actions have been forgotten and  
4   like-to-like comparisons are difficult to make. SDG&E's proposed website display for  
5   residential customers can be classified as day-late information feedback, providing  
6   information in a sufficiently timely manner to optimize the home heating and cooling,  
7   but too late to be instructive for most daily household appliance and lighting use.

8           Ratepayer savings will come in three primary areas: temperature adjustments  
9   while actively occupying a residence, temperature adjustments while sleeping and out  
10   of residence, and improvements to the envelope of the home. Hardly any ratepayer  
11   knows the cost difference in dollars between cooling a house to 74° compared to  
12   cooling the house to 68°, or the dollar value of changing the thermostat settings at  
13   night.

14          With day-late information feedback, learning the difference is cheap, simple,  
15   and quick. Each ratepayer who chooses to utilize the personalized online  
16   consumption information can then make individual, educated decisions about heating  
17   and cooling their home. The same day-late information feedback provides positive  
18   reinforcement and monetary valuation for home-improvement projects.  
19   Homeowners (and to a lesser extent renters) will be able to overcome the mistrust  
20   obstacle associated with energy efficiency literature, by confirming actual savings  
21   online from adding insulation, weather-stripping, window shades, etc.

## V. THE METHODOLOGY

The electricity and gas consumption reduction figures of 0.7% and 2.3%, respectively, result from the application of the following six prominent energy feedback studies:

**TABLE 10-1**  
**Summary of Real-Time Information Feedback Case Studies**

	<u>Savings</u>	<u>Energy</u>
<b>Real-time Displays</b>		
Dobson & Griffith (1992) <sup>6</sup>	<b>13%</b>	<b>Electricity</b>
	<i>End-use specific computer display of real-time electricity consumption</i>	
McClelland & Cook (1979) <sup>7</sup>	<b>12%</b>	<b>Electricity</b>
	<i>Fitch monitors in all electric homes, eleven month study, seminal study</i>	
Wood & Newbrough (2003) <sup>8</sup>	<b>15%</b>	<b>E Range</b>
	<i>Display on electric range of cooking energy use – appliance study</i>	
Mountain (2006) <sup>9</sup>	<b>6.5%</b>	<b>Electricity</b>
	<i>Blue Line monitor on 400 homes, 2 1/2yr study, several minute info delay</i>	
<b>Cumulative Displays</b>		
Van Houwelingen & Raaij (1989) <sup>10</sup>	<b>12%</b>	<b>Gas</b>
	<i>ECL monitor with participation goal of 10% reduction</i>	
Hutton & Mauser (1986) <sup>11</sup>	<b>4-7%</b>	<b>Electricity &amp; Gas</b>
	<i>Electricity and Gas combined in BTU use display ECL, subgroups</i>	

<sup>6</sup> Dobson JK and Griffin JD, 1992, "Conservation Effect of Immediate Electricity Cost Feedback on Residential Consumption Behavior," Proceedings of the 7<sup>th</sup> ACEEE Summer Study on Energy Efficiency in Buildings, Washington, D.C., Vol. 10, p. 33-35.

<sup>7</sup> McClelland L and Cook SW, 1979, "Energy Conservation Effects of Continuous In-home Feedback in All-electric Homes," Journal of Environmental Systems, 9 (2), p. 169-173.

<sup>8</sup> Wood G and Newbrough M, 2002, "Dynamic Energy-Consumption Indicators for Domestic Appliances: Environment, Behavior and Design," Energy and Buildings, 35, p. 821-841.

<sup>9</sup> Mountain D, 2006, "The Impact of Real-Time Feedback on Residential Electricity Consumption: the Hydro One Pilot," Mountain Economic Consulting and Associates Inc., Ontario.

<sup>10</sup> Van Houwelingen JH and Van Raaij WF, 1989, "The Effect of Goal-Setting and Daily Electronic Feedback on In-home Energy Use," Journal of Consumer Research, 16, p. 98-105.

<sup>11</sup> Hutton RB and Filiatraut GA and Mauser GA and Ahtola OT, 1986, "Effects of Cost Related Feedback on Consumer Knowledge and Consumption Behavior," Journal of Consumer Research, Vo 12, p 327-336.

1       Whereas real-time meters work like a speedometer - showing the current rate  
2 of energy consumption, the cumulative displays act like an odometer - showing total  
3 energy used to date. Hence, the feedback-information provided by cumulative  
4 displays are closer to day-late information, in that their display primarily provides  
5 insight into energy used for heating and cooling. The six academic papers relating to  
6 real-time and cumulative displays allow us to estimate probable savings afforded by  
7 the information feedback value of AMI information day-late over the internet.

8       The academic literature in Table 10-1 shows that real-time information-  
9 feedback allowed ratepayers to reduce whole-house electricity consumption between  
10 6.5% and 12.9%. Studies by Van Houwelingen and Van Raaij (1989) and Hutton  
11 and Mauser (1986) show that ratepayers will benefit in similar fashion from  
12 information feedback of natural gas information, as was shown by the real-time  
13 studies of electricity information.

14       The work of McClelland & Cook (1979) elucidates the concept that day-late  
15 presentation of energy feedback-information provides real-time presentation of  
16 heating and cooling information only. In effect, that portion of the electricity and  
17 natural gas bills that represent heating and cooling costs are to be considered subject  
18 to real-time consumption reduction when presented within one day. In EPRI's  
19 March 2006 report titled, "Direct Energy Feedback Technology Assessment," the  
20 authors summarize that "*Daily feedback has an impact on heating and cooling.*  
21 *Continuous or real-time feedback affects other energy uses*".

22       DRA has chosen the 6.5% consumption reduction value from Dr. Mountain's  
23 research for real-time benefit calculations because, among the studies reviewed, his  
24 study is: the most recent (2006), the longest trial period (2.5 years), the largest sample  
25 size, and the most conservative valuation. In estimating electricity and natural gas  
26 consumption reduction by the average participant, only that portion of the bill that  
27 relates to heating and cooling activities were estimated to be subject to the 6.5% real-

1 time consumption reduction value. The average residential ratepayer in SDG&E's  
2 territory uses 10%<sup>12</sup> of his electricity consumption for heating and cooling. Thus,  
3 DRA estimates that the information feedback will allow him to reduce his electricity  
4 consumption by 0.7% (6.5% x 10%). Similarly, day-late information feedback will  
5 allow the average residential ratepayer to reduce his natural gas consumption  
6 by 2.3%<sup>13</sup>.

## 7 **VI. MS. NEWMAYER'S BUDGETING AND PLANNING TOOL**

8 The front page of the Los Angeles Times on August 5, 2006, featured an  
9 article on the past month's shockingly high electricity bills. In this article, the  
10 reporter described how Ms. Newmeyer, of Duarte, California, had her electricity bill  
11 increased from \$149 in June to \$322<sup>14</sup> in July. Ms. Newmeyer said of the jump in  
12 price, "After I was shocked, I was livid." Her energy use did not increase nearly as  
13 much as her bill and the retiree had no way of checking her electricity tab during the  
14 month to help her make electricity consumption and monthly budgeting decisions.  
15 She had every right to be mad.

16 Part of the ratepayers' shock, reported in the Los Angeles Times, reflected the  
17 "inverted tier structure" of electricity pricing. The price that customers pay the  
18 major regulated California utilities for a unit of electricity changes with usage. The  
19 first unit of energy that Ms. Newmeyer purchased cost only six cents (\$0.06/kWh).  
20 During the month of July, as Ms. Newmeyer's electricity consumption increased, the  
21 price per unit cost of her energy rose and rose (like the way tax rates increase for  
22 incrementally higher income brackets). The last unit of energy Ms. Newmeyer  
23 purchased cost almost 500% more than the first unit of energy. While there are  
24 various good public policy reasons for the change in price, the fact that

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<sup>12</sup> 4% heating and 6% cooling, SDG&E DR #33

<sup>13</sup> (6.5% x 36% gas used for heating, DR #33)

<sup>14</sup> In the same article, Lynda Ziegler, Senior Vice President of SCE, stated that "a typical household that usually pays \$80 per month, but doubled its usage during the heat wave, would see a three-fold jump as the bill for July climbs to \$263." [more precisely – the bill jumps 329%]

1 Ms. Newmeyer could not find out, during the month, when the cost of her electricity  
2 stepped up in price is simply not fair. She should be able to find out the price of  
3 energy she is buying before being hit with a very large bill. Her anger was quite  
4 understandable.

5 The solution is a well designed information feedback system. SDG&E should  
6 be required to present each website-registered customer's energy use data (gas and  
7 electric) in a way that would allow customers to budget and plan their energy use.  
8 Many ratepayers will find that relatively small electricity savings will save them a  
9 disproportionately large amount of money on their monthly bill.

## 10 **VII. CONCLUSION**

11 SDG&E should recognize information feedback as one of the most important  
12 aspects of any AMI system from the perspective of the ratepayer. Accordingly,  
13 SDG&E should shift assets and management focus to the design and advertising of  
14 their proposed information-feedback internet site. SDG&E has performed an  
15 extensive analysis of ways in which information collected by AMI will help their own  
16 operations – now there needs to be a focus on how the same information can help  
17 ratepayers manage their home consumption. With a well-designed information-  
18 feedback internet site, consumption reduction by empowered consumers should  
19 reduce utility operating costs by at least a net present value of \$29,600,000 over the  
20 lifetime of SDG&E's AMI system<sup>15</sup>.

21 Furthermore, the Commission should require SDG&E to investigate ways to  
22 empower consumers to receive real-time information feedback on privately owned (or  
23 rented) devices. Day-late information feedback of gas and electric allows educated  
24 management of heating and cooling costs, while real-time information feedback  
25 allows management of all electricity uses.

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<sup>15</sup> One lifecycle analysis 2007-2027